

International Journal on Advanced Science, Engineering and Information Technology **Open Access**
Volume 7, Issue 6, 2017, Pages 2302-2307

Convolutional neural networks and deep belief networks for analysing imbalanced class issue in handwritten dataset (Article)

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Abstract View references (21)

Imbalanced class is one of the trials in classifying materials of big data. Data disparity produces a biased output of a model regardless how recent the technology is. However, deep learning algorithms such as convolutional neural networks and deep belief networks have proven to provide promising results in many research domains, especially in image processing as well as time series forecasting, intrusion detection, and classification. Therefore, this paper will investigate the effect of imbalanced data discrepancy of classes in MNIST handwritten dataset using convolutional neural networks and deep belief networks. Based on the experiment conducted, the results show that although the algorithm is suitable for multiple domains and have shown stability, the imbalanced distribution of data still able to affect the overall performance of the models.

Author keywords

Convolutional neural network Deep belief network Imbalanced class

ISSN: 20885334 Document Type: Article
Source Type: Journal Publisher: Insight Society
Original language: English

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☐ 1

Wang, T., Wu, D.J., Coates, A., Ng, A.Y.

End-to-end text recognition with convolutional neural networks

(2012) *Proceedings - International Conference on Pattern Recognition*, art. no. 6460871, pp. 3304-3308. Cited 220 times.
ISBN: 978-499064410-9

☐ 2

Dieleman, S., Brakel, P., Schrauwen, B.


Audio-based music classification with a pretrained convolutional network

(2011) *Proceedings of the 12th International Society for Music Information Retrieval Conference, ISMIR 2011*, pp. 669-674. Cited 36 times.
ISBN: 978-061554865-4

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- 3 Le, D., Provost, E.M.
 , pp. 216-221.
 in 2013 IEEE Workshop on Automatic Speech Recognition and Understanding IEEE, 2013
<http://ieeexplore.ieee.org/document/6707732/>

- 4 Hensman, P., Masko, D.
 (2015) *The Impact of Imbalanced Training Data for Convolutional Neural Networks*. Cited 9 times.
 PhD
https://www.kth.se/social/files/588617ebf2765401cfcc478c/PHensmanDMasko_dkand15.pdf

- 5 Yan, Y., Chen, M., Shyu, M.-L., Chen, S.-C.
Deep Learning for Imbalanced Multimedia Data Classification
 (2015) *Proceedings - 2015 IEEE International Symposium on Multimedia, ISM 2015*, art. no. 7442383, pp. 483-488. Cited 8 times.
 ISBN: 978-150900379-2
 doi: 10.1109/ISM.2015.126
[View at Publisher](#)

- 6 Liu, Y., Yu, X., Huang, J.X., An, A.
Combining integrated sampling with SVM ensembles for learning from imbalanced datasets
 (2011) *Information Processing and Management*, 47 (4), pp. 617-631. Cited 61 times.
 doi: 10.1016/j.ipm.2010.11.007
[View at Publisher](#)

- 7 Fernández, A., García, S., Herrera, F.
Addressing the classification with imbalanced data: Open problems and new challenges on class distribution
 (2011) *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 6678 LNAI (PART 1), pp. 1-10. Cited 28 times.
 ISBN: 978-364221218-5
 doi: 10.1007/978-3-642-21219-2-1
[View at Publisher](#)

- 8 Chawla, N.V., Japkowicz, N., Kolcz, A.
 Editorial: Special Issue on Learning from Imbalanced Data Sets
 (2004) *ACM SIGKDD Explorations Newsletter*, 6, pp. 1-6. Cited 824 times.

- 9 Berry, J., Fasel, I., Fadiga, L., Archangeli, D.
Training deep nets with imbalanced and unlabeled data
 (2012) *13th Annual Conference of the International Speech Communication Association 2012, INTERSPEECH 2012*, 2, pp. 1754-1757. Cited 5 times.
 ISBN: 978-162276759-5

- 10 Weiss, G., Provost, F.
 (2001) *The effect of class distribution on classifier learning: an empirical study*. Cited 197 times.
 Rutgers Univ
<ftp://ftp.cs.rutgers.edu/http/cs/cs/pub/technical-reports/work/ml-tr-44.pdf>

-
- ☐ 11 Liu, W., Chawla, S.
Class confidence weighted kNN algorithms for imbalanced data sets

(2011) *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 6635 LNAI (PART 2), pp. 345-356. Cited 52 times.
ISBN: 978-364220846-1
doi: 10.1007/978-3-642-20847-8-29

View at Publisher
-
- ☐ 12 Nair, V., Hinton, G.E.
3D object recognition with Deep Belief Nets

(2009) *Advances in Neural Information Processing Systems 22 - Proceedings of the 2009 Conference*, pp. 1339-1347. Cited 162 times.
ISBN: 978-161567911-9
-
- ☐ 13 Mohamed, A.-R., Yu, D., Deng, L.
Investigation of full-sequence training of deep belief networks for speech recognition

(2010) *Proceedings of the 11th Annual Conference of the International Speech Communication Association, INTERSPEECH 2010*, pp. 2846-2849. Cited 106 times.
-
- ☐ 14 Abdel-Hamid, O., Deng, L., Yu, D.
Exploring convolutional neural network structures and optimization techniques for speech recognition

(2013) *Proceedings of the Annual Conference of the International Speech Communication Association, INTERSPEECH*, pp. 3366-3370. Cited 87 times.
<http://www.isca-speech.org>
-
- ☐ 15 Matsugu, M., Mori, K., Mitari, Y., Kaneda, Y.
Subject independent facial expression recognition with robust face detection using a convolutional neural network

(2003) *Neural Networks*, 16 (5-6), pp. 555-559. Cited 109 times.
www.elsevier.com/locate/neunet
doi: 10.1016/S0893-6080(03)00115-1

View at Publisher
-
- ☐ 16 Cireřan, D.C., Meier, U., Masci, J., Gambardella, L.M., Schmidhuber, J.
Flexible, high performance convolutional neural networks for image classification

(2011) *IJCAI International Joint Conference on Artificial Intelligence*, pp. 1237-1242. Cited 259 times.
ISBN: 978-157735512-0
doi: 10.5591/978-1-57735-516-8/IJCAI11-210

View at Publisher
-
- ☐ 17 Lopes, N., Ribeiro, B., Gonçalves, J.
Restricted Boltzmann Machines and Deep Belief Networks on multi-core processors

(2012) *Proceedings of the International Joint Conference on Neural Networks*, art. no. 6252431. Cited 13 times.
ISBN: 978-146731490-9
doi: 10.1109/IJCNN.2012.6252431

View at Publisher
-

□ 18 Hinton, G.E.
Learning multiple layers of representation
(2007) *Trends in Cognitive Sciences*, 11 (10), pp. 428-434. Cited 327 times.
doi: 10.1016/j.tics.2007.09.004
[View at Publisher](#)

□ 19 Sun, Y., Wang, X., Tang, X.
Hybrid deep learning for face verification
(2013) *Proceedings of the IEEE International Conference on Computer Vision*, art. no. 6751295, pp. 1489-1496. Cited 101 times.
ISBN: 978-147992839-2
doi: 10.1109/ICCV.2013.188
[View at Publisher](#)

□ 20 Ranzato, M., Krizhevsky, A., Hinton, G.E.
Factored 3-way restricted Boltzmann machines for modeling natural images
(2010) *Journal of Machine Learning Research*, 9, pp. 621-628. Cited 50 times.
[View at Publisher](#)

□ 21 LeCun, Y., Cortes, C.
(2010) *MNIST handwritten digit database*. Cited 120 times.
AT&T Labs [Online]
<http://yann.lecun.com/exdb/mnist>

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